Integrating the Par Lab Stack
Running Damascene on SEJITS/ROS/RAMP Gold

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Par Lab Winter Retreat 2010

Integrating the Stack

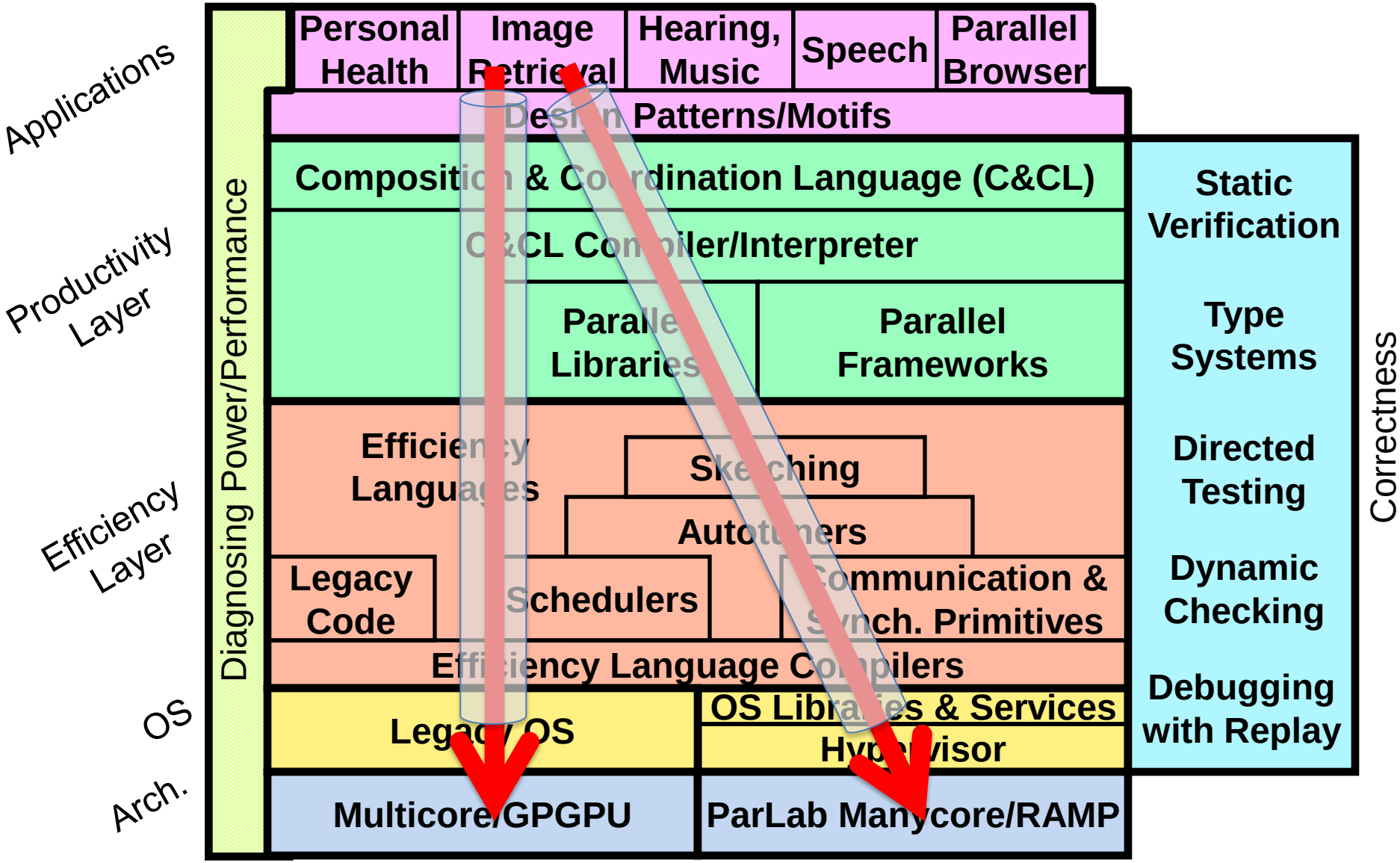
- Overall Goal of the Par Lab:

  Create Productive, Efficient, Correct, Portable SW for 100+ cores that scales as the core count increase every 2 years (!)

- Tremendous Progress has been made at individual layers in the Par Lab Software Stack

- This Demo is an attempt to demonstrate our integration effort across multiple layers

Integrating the Stack



Integrating the Stack

Damascene

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- Parallel implementation of the Global Probability of Boundary (gPB) image contour detection algorithm

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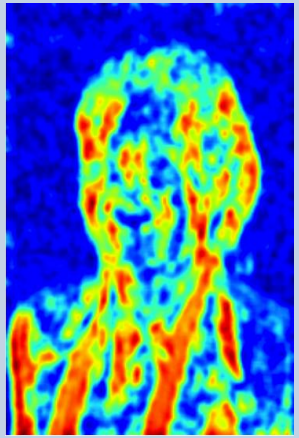
TG, R=5



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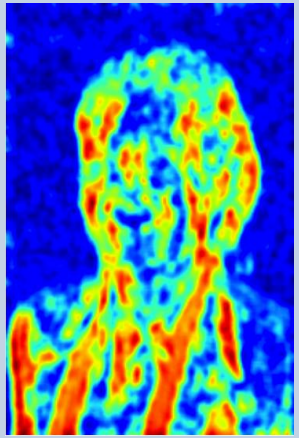
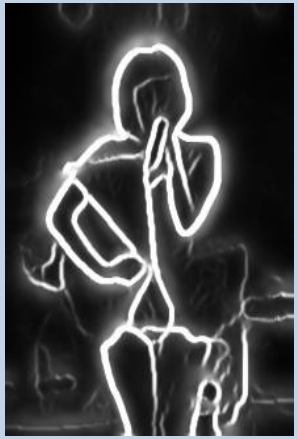


Full gPB



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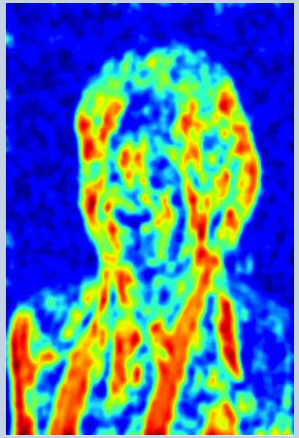

Full gPB

Damascene

- Parallel implementation of the Global Probability of Boundary (gPB) image contour detection algorithm
- Algorithm developed by Prof. Jitendra Malik's Vision Group at UCB
- Bryan Catanzaro et al. parallelized the code using CUDA, including some algorithmic changes (presented at last years winter retreat)
- We've now parallelized the same code in C and gotten it running in the python/SEJITS framework
- This demo shows this parallelization effort in action
- More details to come.....

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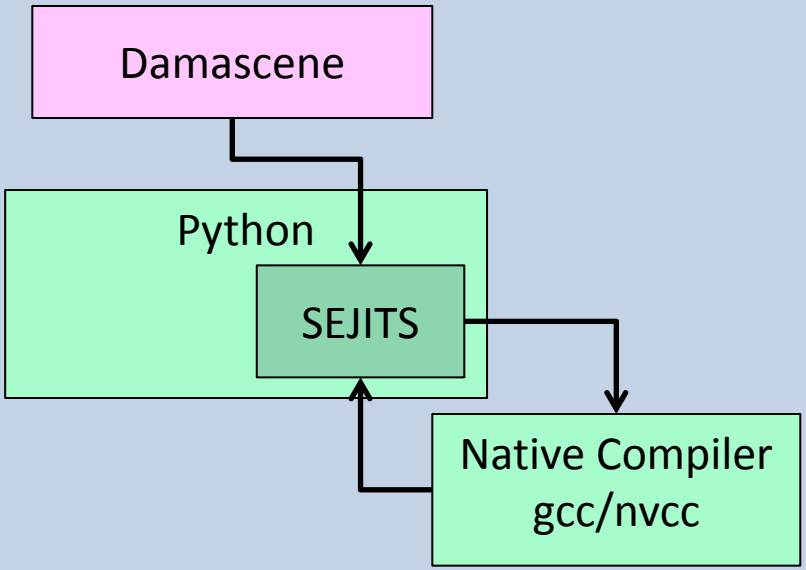

Python/SEJITS

- We picked a small subset of the full Damascene code and implemented it for SEJITS in python using two parallel constructs

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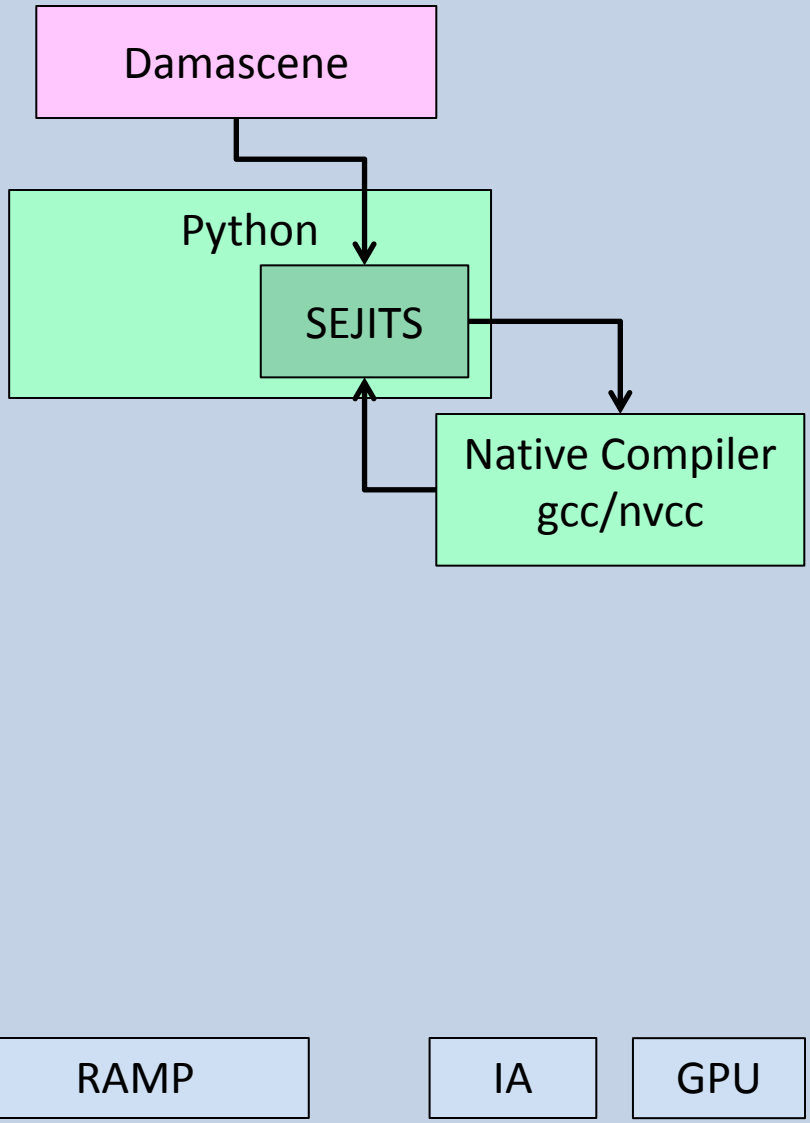


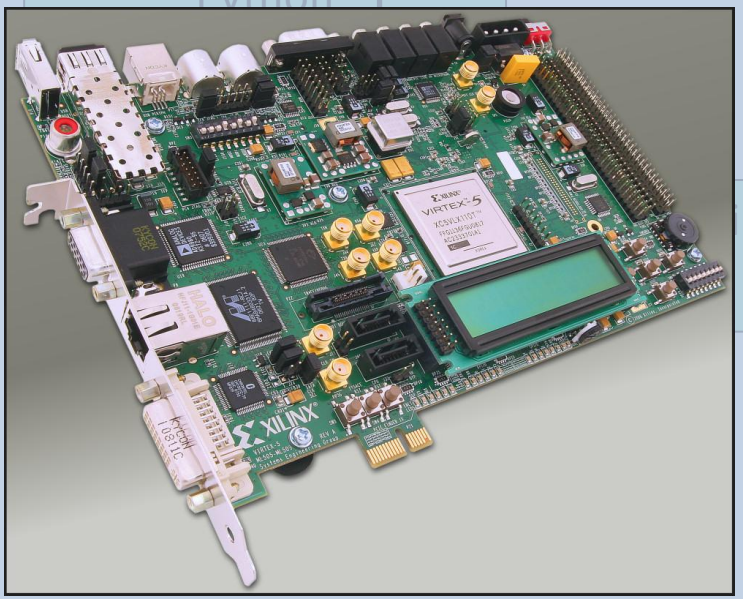
Python/SEJITS

- We picked a small subset of the full Damascene code and implemented it for SEJITS in python using two parallel constructs
- Since SEJITS targets x86, NVIDIA GPUs, and SPARC v8 (i.e. RAMP Gold) the Damascene application can now run on all three platforms

Integrating the Stack

Damascene

Python



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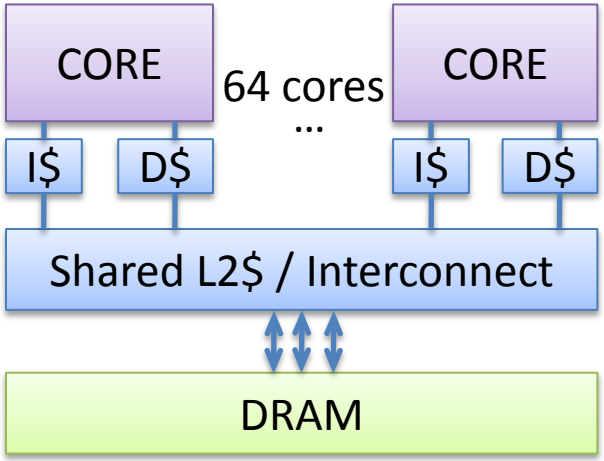
RAMP

IA

GPU

RAMP Gold

- Par Lab architecture simulator on an FPGA
- 64-core SPARC V8 target machine
- Runtime-configurable memory hierarchy
- 50 MIPS on Xilinx LX110T
  - 269x faster than comparable software simulator (SIMICS+GEMS)
- Sufficient HW support (MMU, timer, …) to boot ROS, Linux 2.6



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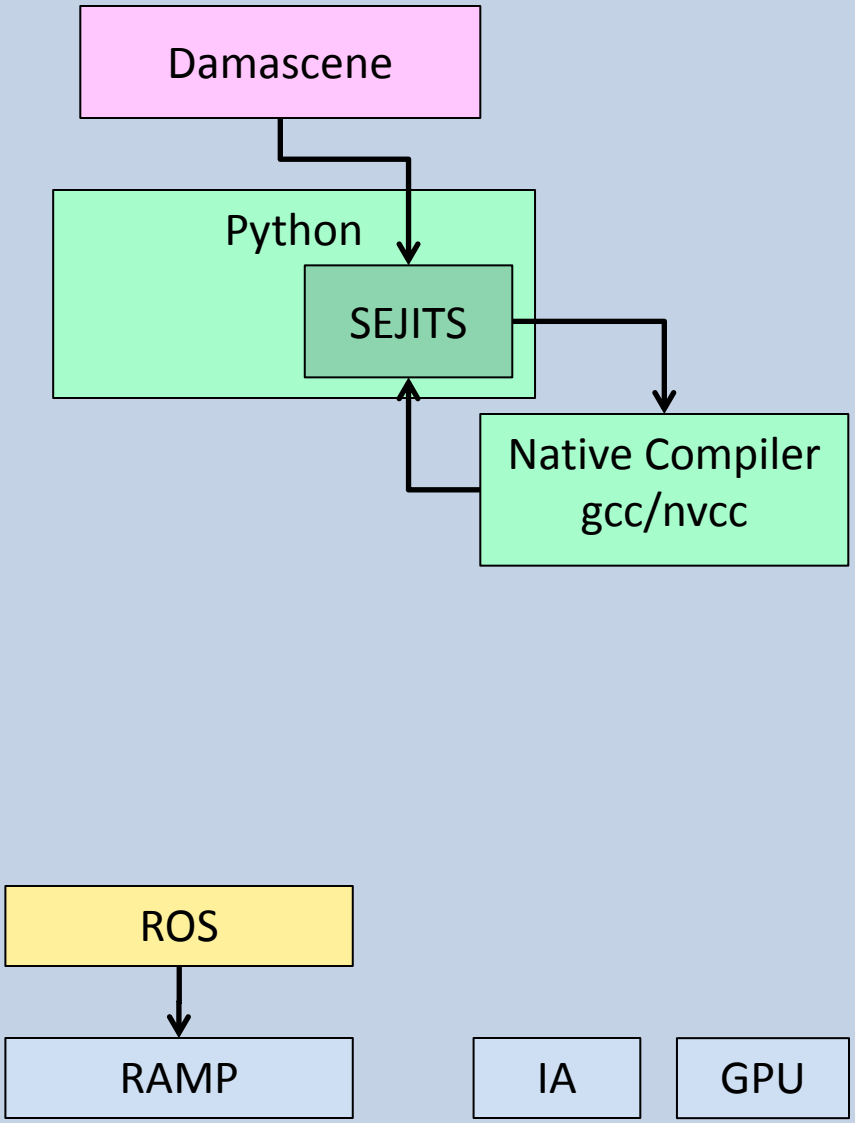

ROS (Tessellation)

- New operating system designed for improved kernel scalability and better support for parallel applications

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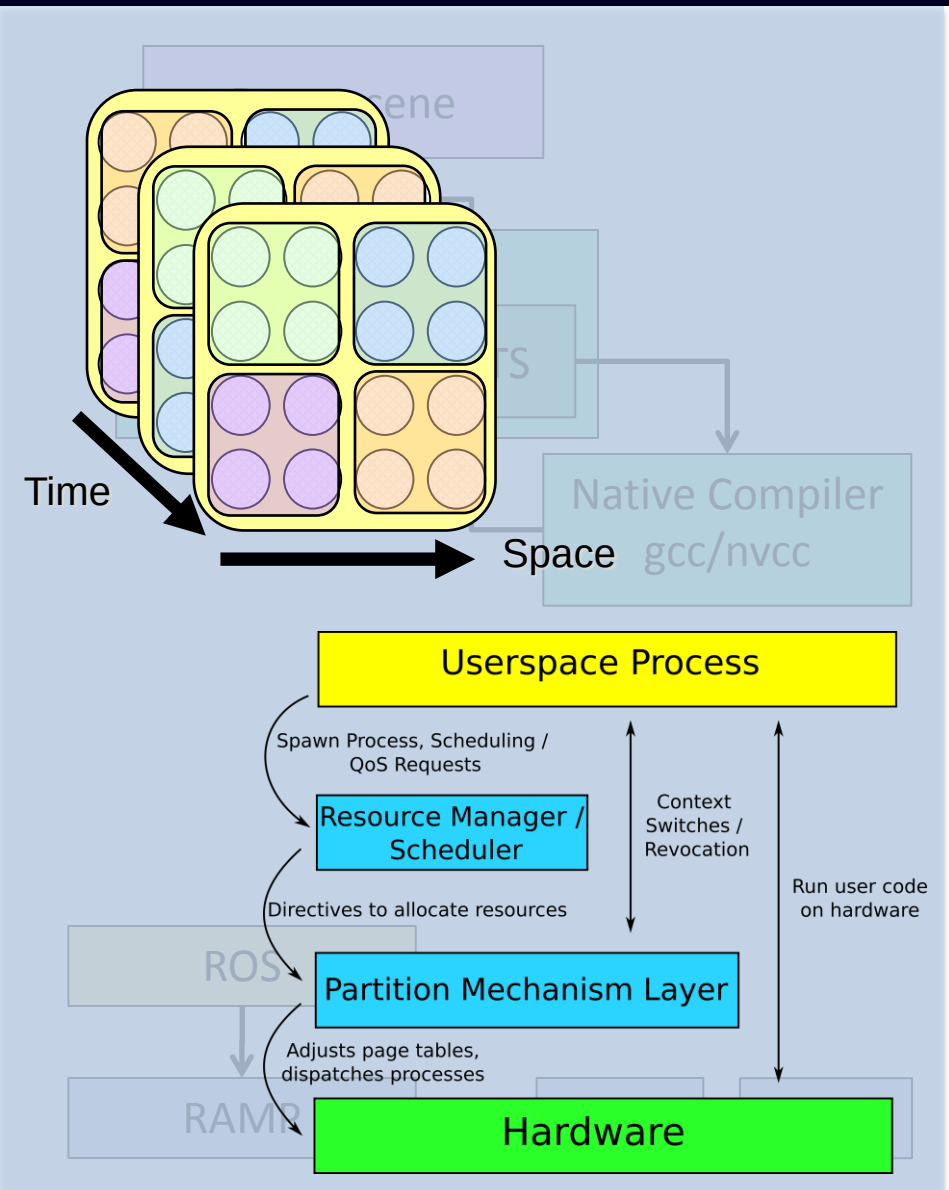

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- Built around idea of Space-Time Partitioning of Resources
  - Resources partitioned amongst execution entities based on explicit requests
  - Execution entities scheduled in both space and time based on meeting resource guarantees
  - Enables predictable application performance
  - Increases isolation

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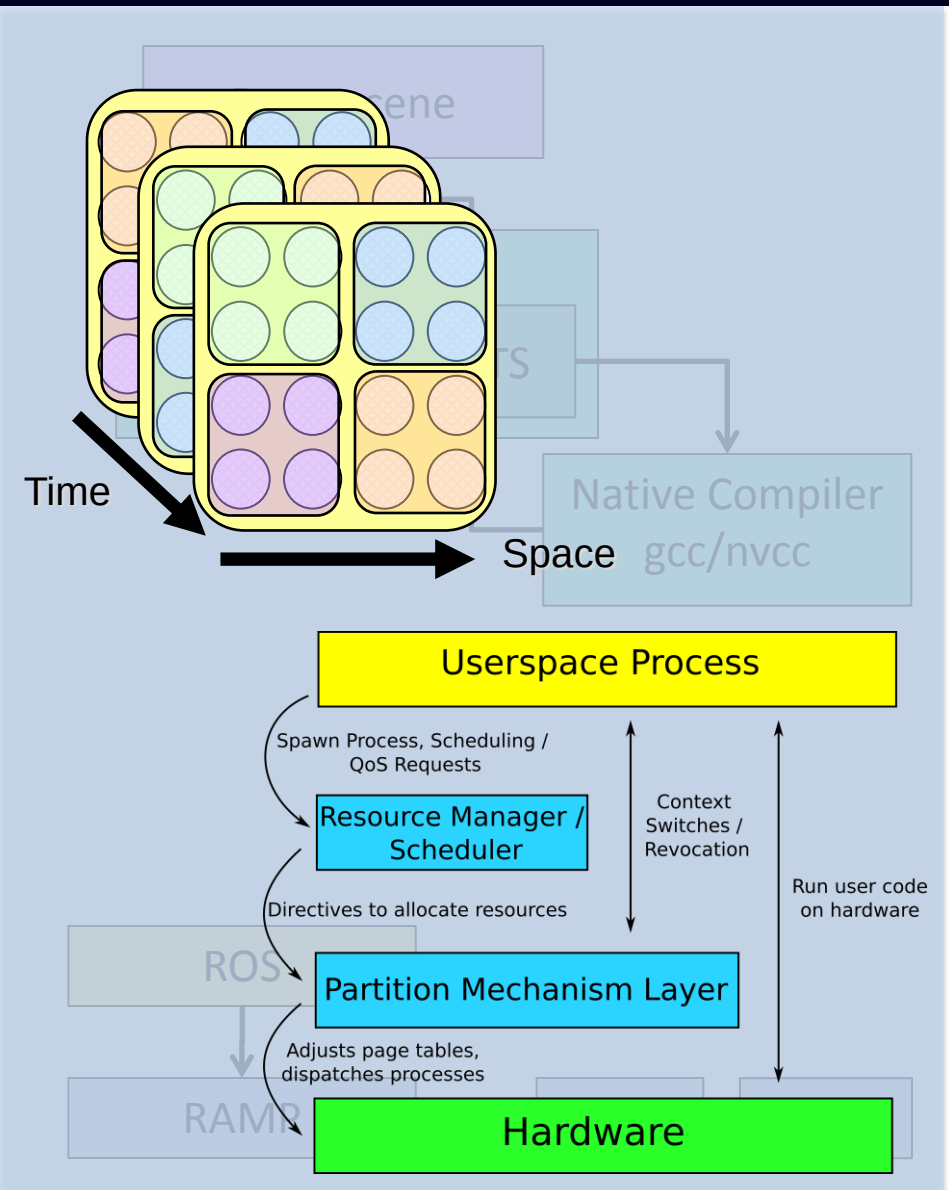

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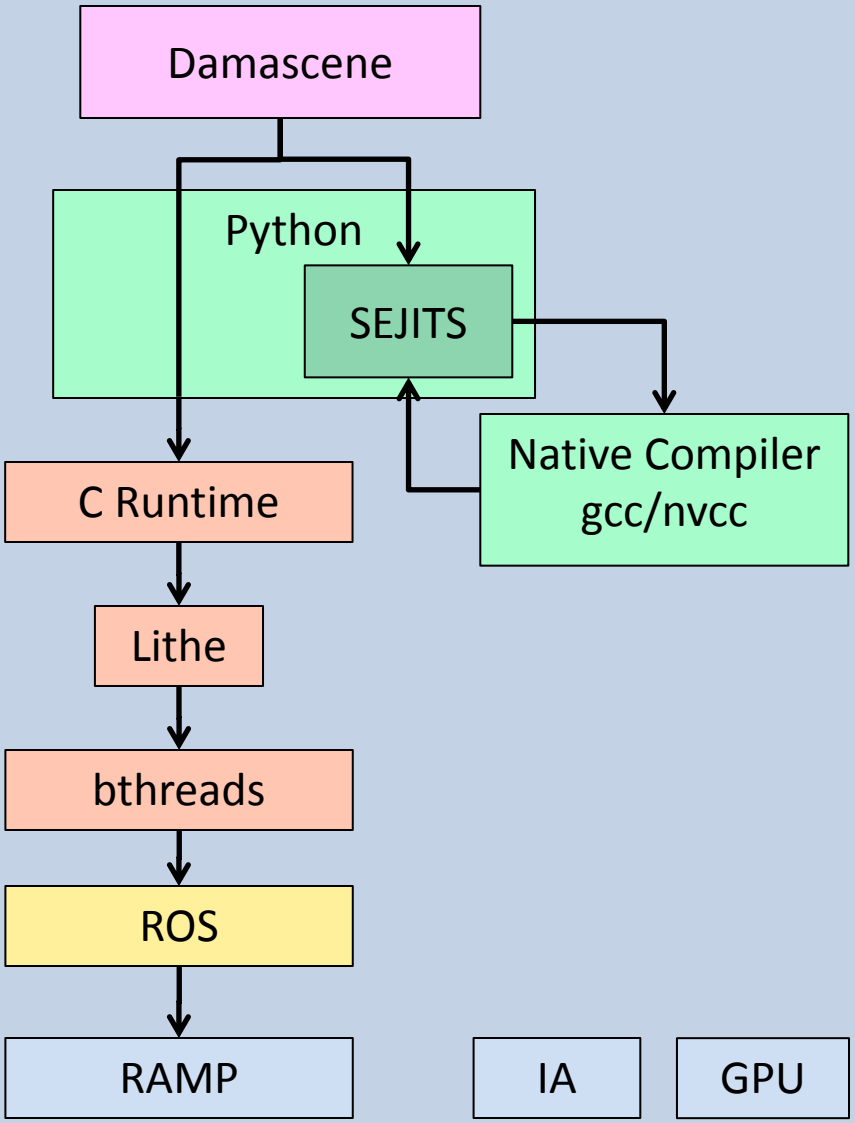
- The Cell/Partition execution model
  - Multiple cores 'owned' by a single cell
  - All cores gang scheduled
  - Exposed via the bthreads/harts ABI

Integrating the Stack



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- Support for **newlib, glibc,** and **parlib**
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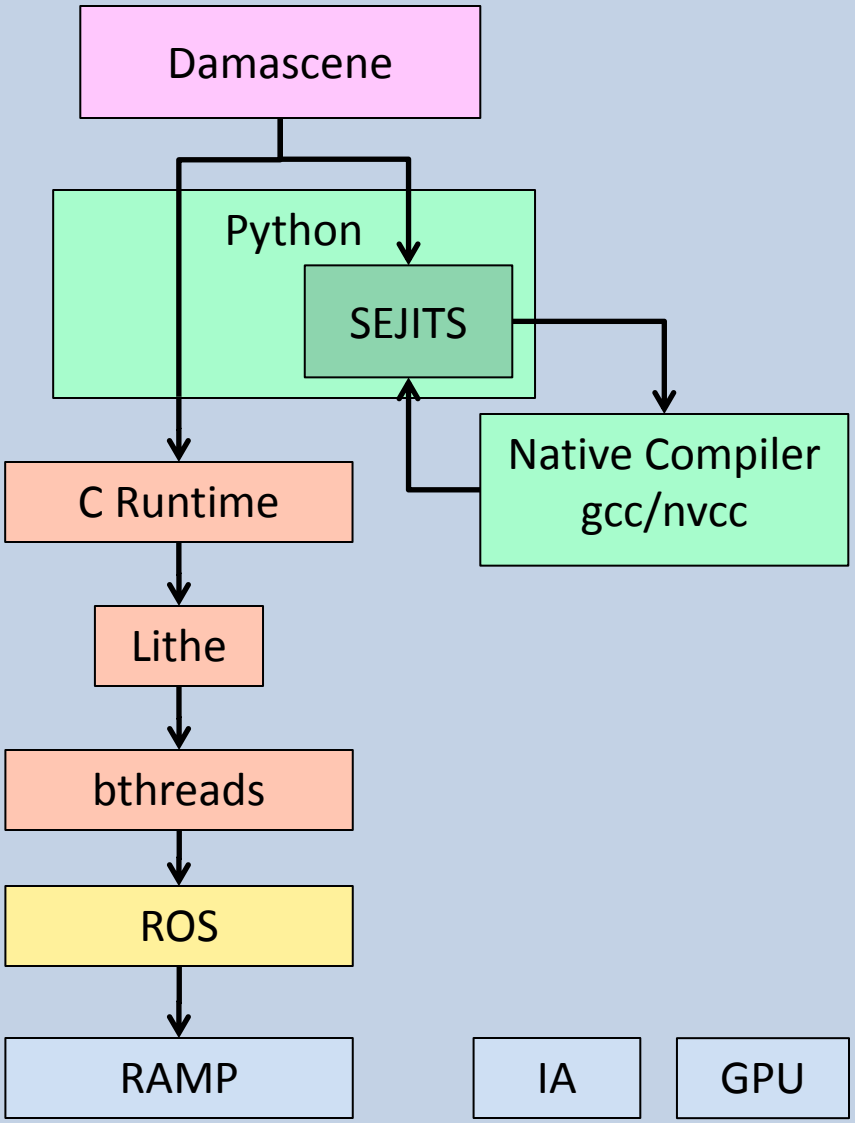

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- Lithe support
  - Liquid threads framework
  - Enables multiple application thread schedulers to run cooperatively
  - Not yet fully integrated (but soon!)
- bthreads / harts ABI
  - Tightly integrated with the OS, providing a userspace abstraction on top of its cell/partition model

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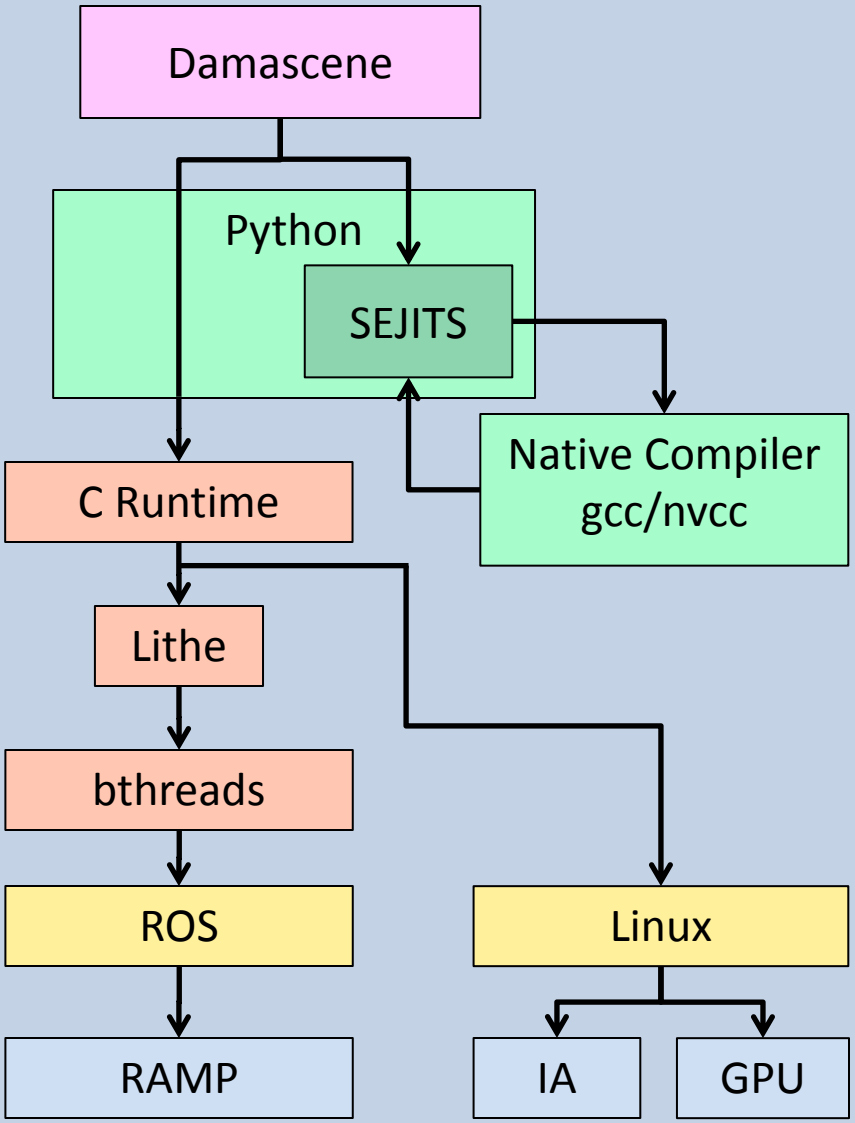

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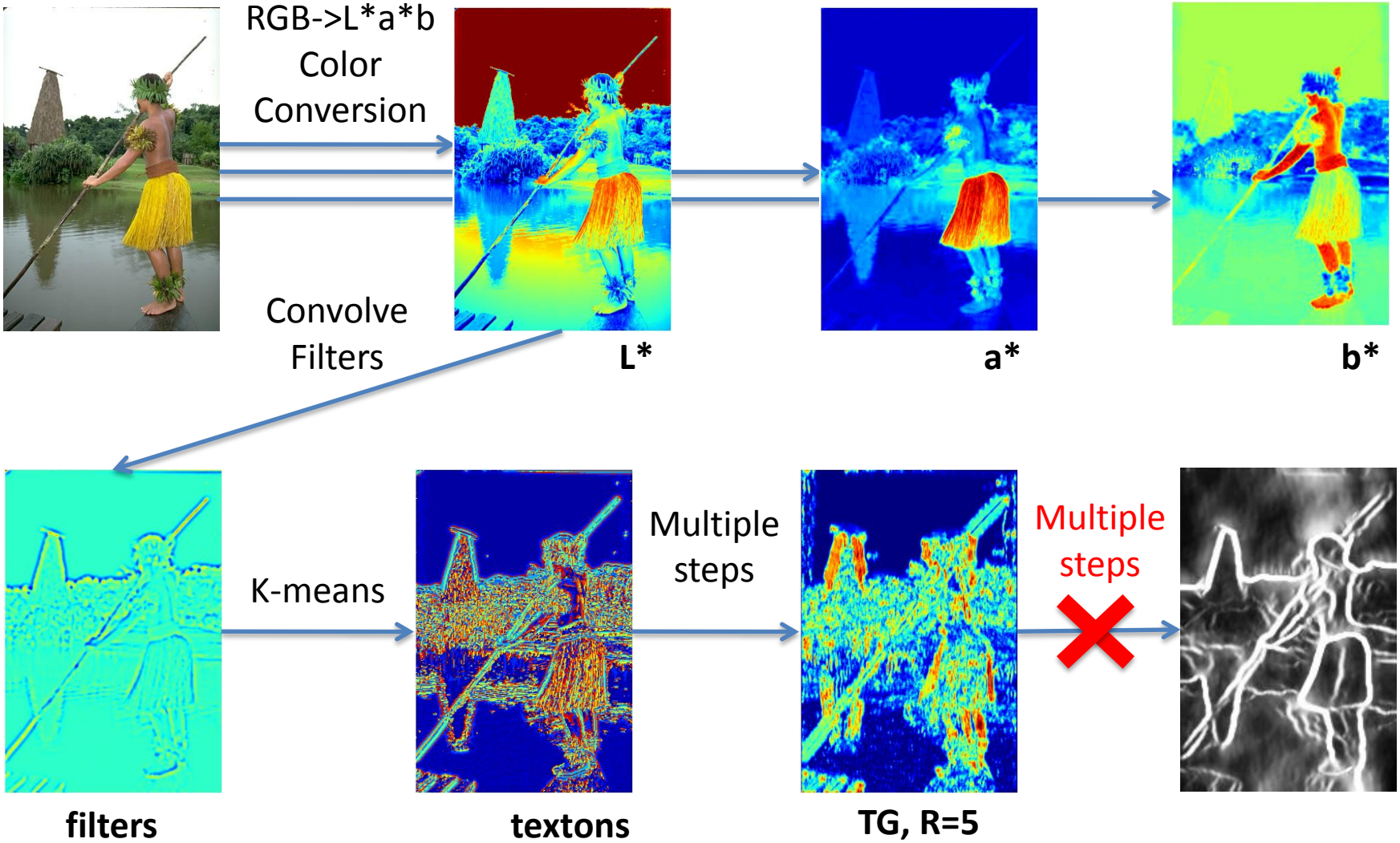
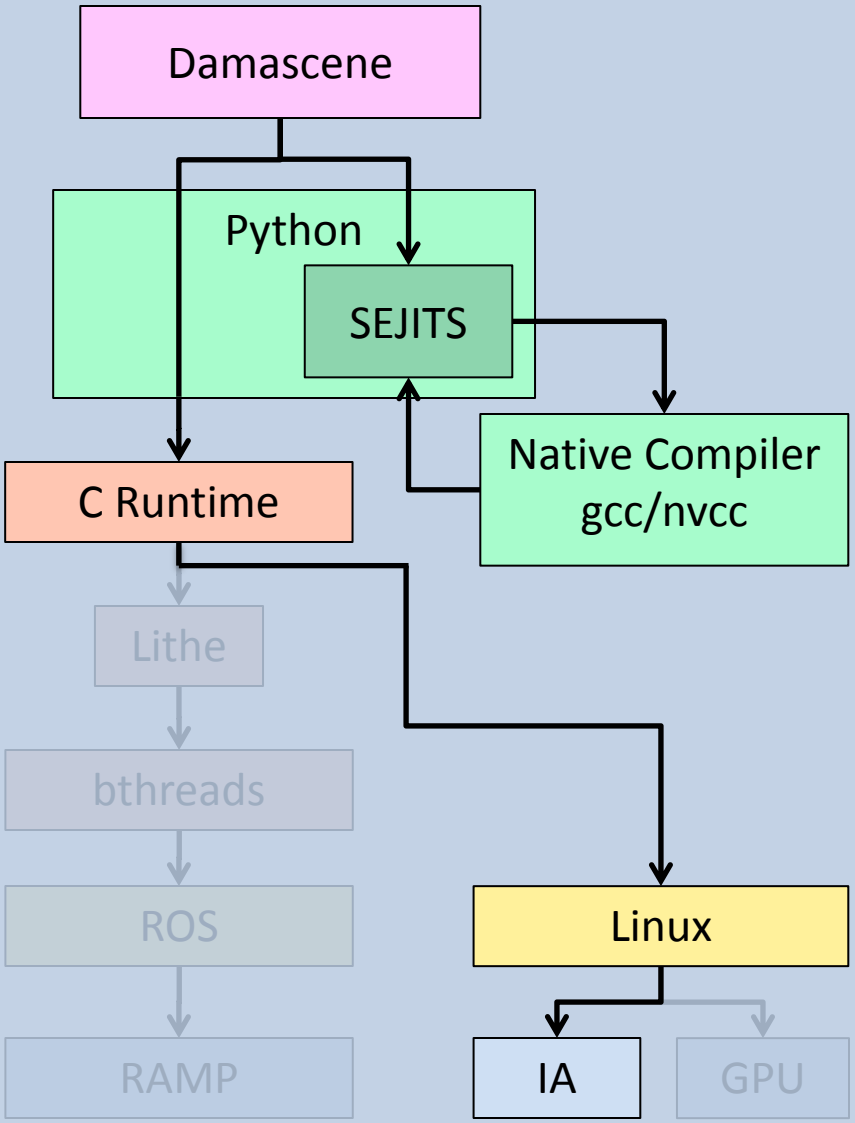
- bthreads / harts ABI
  - Tightly integrated with the OS, providing a userspace abstraction on top of its cell/partition model
- Also support for legacy OS integration

DEMO

Damascene: Intermediate Steps



Paths Through the Stack



- Damascene
- Python/SEJITS
- C Runtime
- Linux
- x86

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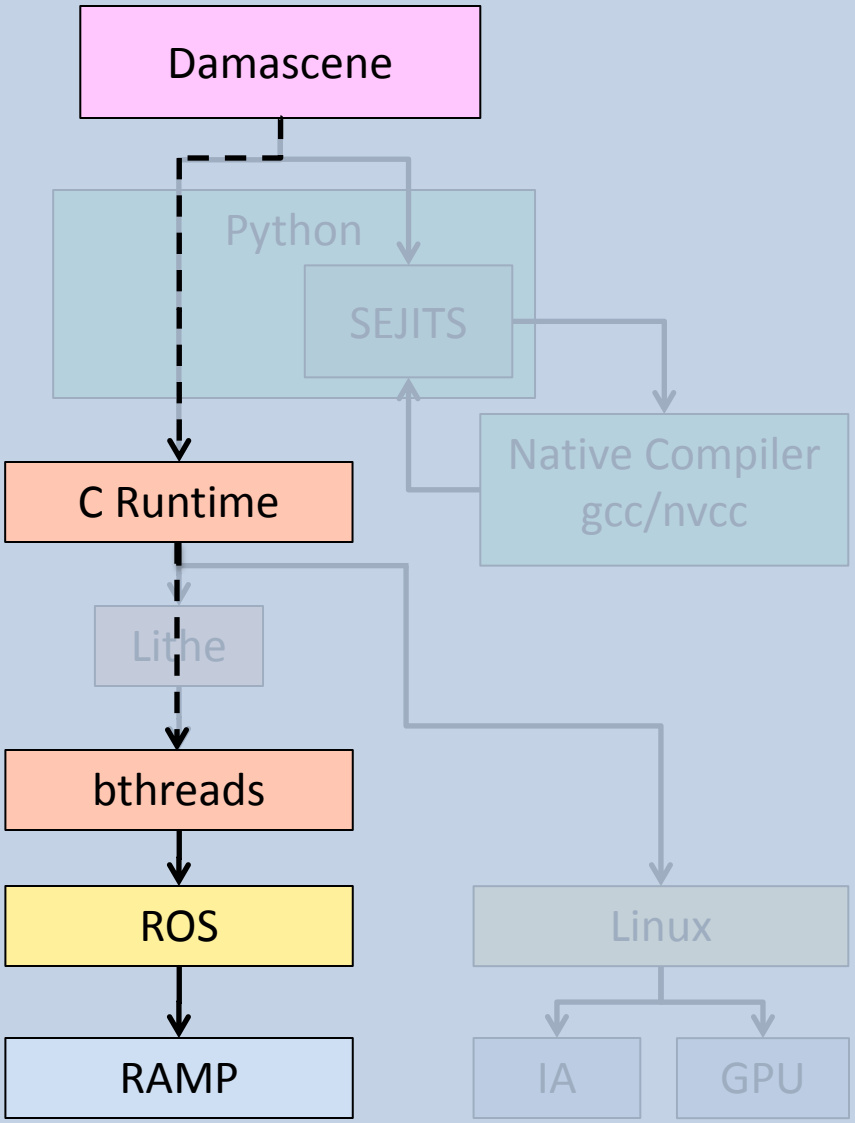

- Damascene
- Native C
- C Runtime
- ROS
- RAMP Gold

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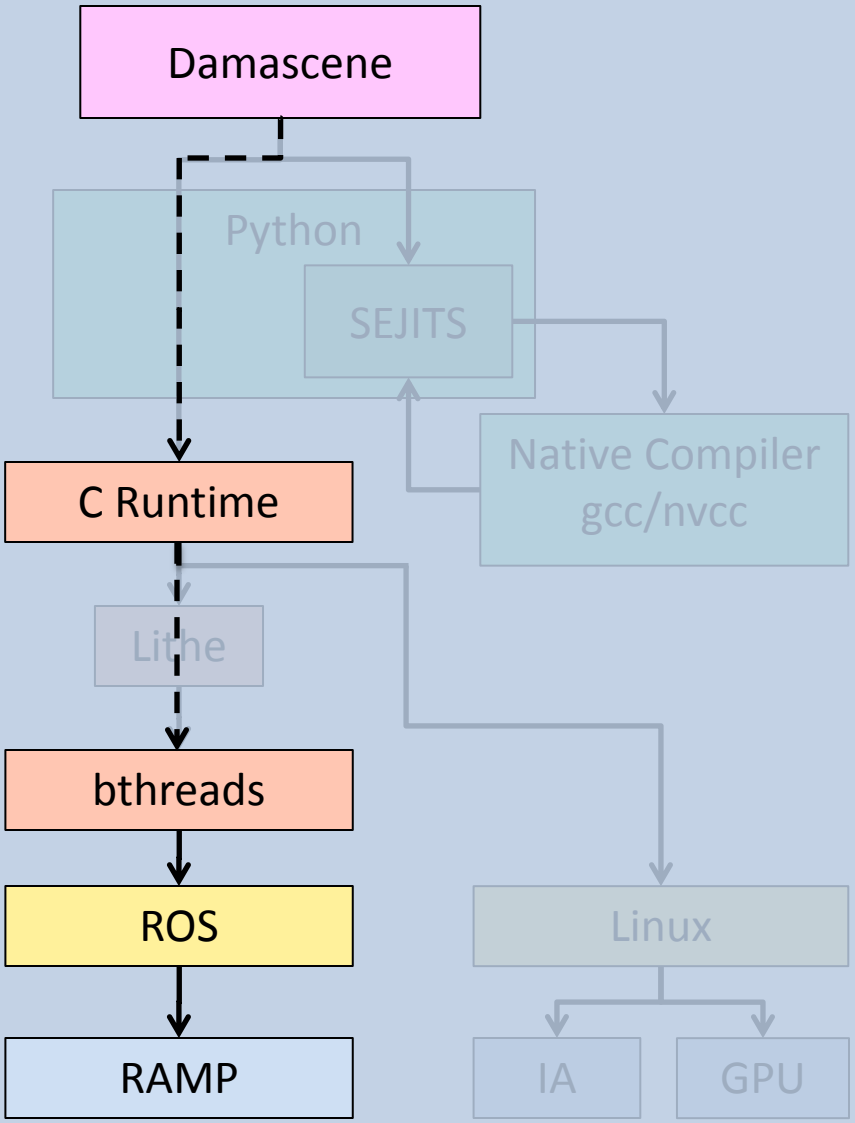

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Time for the Demo!
(and questions while we set up)